MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2019/2020

BDS4614 – MANAGEMENT DECISION SCIENCE

(All Sections/Groups)

12 JUNE 2020
9.00 a.m. - 12.00 p.m.
(3 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 7 pages excluding the cover page.
2. Answer ALL questions. The distributions of the marks are given for all questions.
3. Write all your answers in the Answer Booklet provided.
4. The statistical table is attached at the end of this question paper.

Question 1

Jenny is preparing three types of candy gift box for the coming school canteen day. For easy reference, the gift boxes are named X, Y, and Z. To prepare the gift box, Jenny bought 1000 chocolate candies, 2000 strawberry candies, and 1500 sweet and sour candies. Each candy gift box X consists of 10 chocolate candies, 15 strawberry candies, and 5 sweet and sour candies. Each candy gift box Y consists of 5 chocolate candies, 15 strawberry candies, and 15 sweet and sour candies. Each candy gift box Z consists of 5 chocolate candies, 20 strawberry candies, and 5 sweet and sour candies. The profit per box of gift box X, Y, and Z is RM5, RM7, and RM5.50 respectively. Jenny is now struggling with how many boxes of each type of candy gift box should be prepared to maximise the profit.

a. Formulate the given problem as a Linear Programming Problem.

(4 marks)

b. Set up the initial simplex tableau by including the necessary slack variables.

(2 marks)

c. Determine the second simplex tableau by using the simplex method.

(4 marks)

Given the following final table

C_j →		5	7	5.5	0	0	0	
	Solution Mix	X	Y	Z	S1	S2	S3	Quantity
0	S1	0	0	-55/6	1	-5/6	1/2	250/3
5	X	1	0	3/2	0	1/10	-1/10	50
7	Y	0	1	-1/6	0	-1/30	1/10	250/3
	Z_j	5	7	19/3	0	4/15	1/5	2500/3
	$C_j - Z_j$	0	0	-5/6	0	-4/15	-1/5	

S1 – slack for chocolate candy
S2 – slack for strawberry candy
S3 – slack for sweet and sour candy

d. How many boxes of each type of candy gift box should be prepared to maximise the profit? What is the maximum profit obtain?

(2 marks)

e. What are the shadow prices of each of the three constraints? Interpret the meaning of the shadow prices.

(5 marks)

f. How much could the number of sweet and sour candies be changed before its shadow price is affected?

(3 marks)

(Total: 20 marks)

Continued …….

Question 2

a. I-Home manufactures table lamps in factories located in Skudai, Kuala Lumpur, and Alor Gajah. The lamps are then shipped to its retail stores in Seremban, Kulai, Ayer Keroh, and Tampin. The transportation cost per unit, factory capacities, and retail store demands are provided in the following table:

Factory	**Retail store**				**Capacity (units)**
	Seremban	**Kulai**	**Ayer Keroh**	**Tampin**	
Skudai	4.0	2.5	3.5	3.8	200
Kuala Lumpur	2.2	3.2	2.8	2.5	250
Alor Gajah	2.4	2.5	1.5	1.2	300
Demand (units)	100	250	250	150	

Determine the optimal transportation plan that would minimise the total transportation cost.

(10 marks)

b. A project manager has separated a project into four different tasks. The four tasks are to be assigned to four staff. The staff are different in capabilities. Thus the time required to complete the tasks are varied. The hours needed for each of the staff to complete the tasks are given in the following table:

Task	**Staff**			
	Tim	Eunice	Jackson	Kenny
A	33	28	35	32
B	28	30	30	29
C	30	28	33	32
D	28	33	30	32

Determine the optimal assignment plan. Find the minimum time require to complete the project.

(10 marks)
(Total: 20 marks)

Continued …….

Question 3

A construction site manager has listed down a list of activities to be completed to ensure that the project can be completed on time. The manager had identified important information based on his experience. The information is as follows:

Activity	Week			Immediate Predecessors
	a	***m***	***b***	
A	4	5	6	-
B	3	4	5	-
C	3	5	7	A
D	2	4	6	B
E	2	5	8	C, D
F	3	4	5	B, E
G	3	4	5	F
H	5	6	7	E, F

a. Construct a network diagram for this problem.
(5 marks)

b. Determine the expected time and variance for each activity.
(3 marks)

c. Determine ES, EF, LS, LF, and slack for each activity.
(5 marks)

d. Determine the critical path, expected completion time and variance.
(3 marks)

e. What is the probability that it takes no more than 28 weeks to complete the project?
(4 marks)

(Total: 20 marks)

Continued …….

Question 4

Sport Life is a sports equipment seller in Melaka. Sport Life is selling a popular brand of shuttlecock, which has an annual demand of 5000. The cost of each shuttlecock is RM8 and the carrying cost per unit per year is estimated to be 5% of the unit cost. It costs Sport life RM300 to place an order and it takes 5 days to receive the order from the supplier.

a. To minimise cost, how many shuttlecocks should be ordered each time an order is placed?

(4 marks)

b. Determine the total annual inventory cost.

(3 marks)

c. If Sport Life operates 300 days a year, what is the ROP?

(3 marks)

d. Is the ROP greater than EOQ? If so, how is this situation handled?

(2 marks)

e. If shuttlecocks is ordered in quantities of 3000 or more, Sport Life can get a 5% discount on the cost of the shuttlecock. Should Sport Life take the discount? Why?

(8 marks)

(Total: 20 marks)

Continued …….

Question 5

Etech has developed a new model of laptop and currently considering the number of laptops to be produced. Under consideration is to produce in large, medium, or small quantities. The market response to the new model may be good, moderate, or poor. The marketing team has estimated the expected payoff under various market conditions, and it is presented in the following table:

Quantity	**Market Response (RM)**		
	Poor	**Moderate**	**Good**
Large	-50,000	200,000	300,000
Medium	-30,000	175,000	225,000
Small	-10,000	150,000	200,000
Probability	0.3	0.4	0.3

a. Determine the best decision, using the following decision criteria

i. Maximax

(2 marks)

ii. Maximin

(2 marks)

iii. Criterion of Realism ($\alpha = 0.7$)

(3 marks)

iv. Minimax Regret

(4 marks)

b. What decision would maximise the expected profit?

(4 marks)

c. What is the minimum expected opportunity loss?

(2 marks)

d. What is the maximum amount that should be paid for a perfect forecast of the market response to the laptop?

(3 marks)

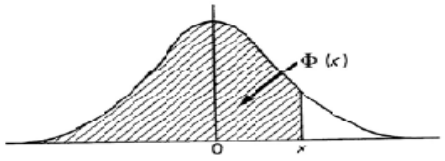
(Total: 20 marks)

Continued …….

Appendix
Statistical Table

TABLE 4. THE NORMAL DISTRIBUTION FUNCTION

The function tabulated is $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{1}{2}t^2}\, dt$. $\Phi(x)$ is the probability that a random variable, normaly distributed with zero mean and unit variance, will be less than or equal to x. When $x < 0$ use $\Phi(x) = 1 - \Phi(-x)$, as the normal distribution with zero mean ard unit variance is symmetric about zero.



x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
0·00	0·5000	0·40	0·6554	0·80	0·7881	1·20	0·8849	1·60	0·9452	2·00	0·97725
·01	·5040	·41	·6591	·81	·7910	·21	·8869	·61	·9463	·01	·97778
·02	·5080	·42	·6628	·82	·7939	·22	·8888	·62	·9474	·02	·97831
·03	·5120	·43	·6664	·83	·7967	·23	·8907	·63	·9484	·03	·97882
·04	·5160	·44	·6700	·84	·7995	·24	·8925	·64	·9495	·04	·97932
0·05	0·5199	0·45	0·6736	0·85	0·8023	1·25	0·8944	1·65	0·9505	2·05	0·97982
·06	·5239	·46	·6772	·86	·8051	·26	·8962	·66	·9515	·06	·98030
·07	·5279	·47	·6808	·87	·8078	·27	·8980	·67	·9525	·07	·98077
·08	·5319	·48	·6844	·88	·8106	·28	·8997	·68	·9535	·08	·98124
·09	·5359	·49	·6879	·89	·8133	·29	·9015	·69	·9545	·09	·98169
0·10	0·5398	0·50	0·6915	0·90	0·8159	1·30	0·9032	1·70	0·9554	2·10	0·98214
·11	·5438	·51	·6950	·91	·8186	·31	·9049	·71	·9564	·11	·98257
·12	·5478	·52	·6985	·92	·8212	·32	·9066	·72	·9573	·12	·98300
·13	·5517	·53	·7019	·93	·8238	·33	·9082	·73	·9582	·13	·98341
·14	·5557	·54	·7054	·94	·8264	·34	·9099	·74	·9591	·14	·98382
0·15	0·5596	0·55	0·7088	0·95	0·8289	1·35	0·9115	1·75	0·9599	2·15	0·98422
·16	·5636	·56	·7123	·96	·8315	·36	·9131	·76	·9608	·16	·98461
·17	·5675	·57	·7157	·97	·8340	·37	·9147	·77	·9616	·17	·98500
·18	·5714	·58	·7190	·98	·8365	·38	·9162	·78	·9625	·18	·98537
·19	·5753	·59	·7224	·99	·8389	·39	·9177	·79	·9633	·19	·98574
0·20	0·5793	0·60	0·7257	1·00	0·8413	1·40	0·9192	1·80	0·9641	2·20	0·98610
·21	·5832	·61	·7291	·01	·8438	·41	·9207	·81	·9649	·21	·98645
·22	·5871	·62	·7324	·02	·8461	·42	·9222	·82	·9656	·22	·98679
·23	·5910	·63	·7357	·03	·8485	·43	·9236	·83	·9664	·23	·98713
·24	·5948	·64	·7389	·04	·8508	·44	·9251	·84	·9671	·24	·98745
0·25	0·5987	0·65	0·7422	1·05	0·8531	1·45	0·9265	1·85	0·9678	2·25	0·98778
·26	·6026	·66	·7454	·06	·8554	·46	·9279	·86	·9686	·26	·98809
·27	·6064	·67	·7486	·07	·8577	·47	·9292	·87	·9693	·27	·98840
·28	·6103	·68	·7517	·08	·8599	·48	·9306	·88	·9699	·28	·98870
·29	·6141	·69	·7549	·09	·8621	·49	·9319	·89	·9706	·29	·98899
0·30	0·6179	0·70	0·7580	1·10	0·8643	1·50	0·9332	1·90	0·9713	2·30	0·98928
·31	·6217	·71	·7611	·11	·8665	·51	·9345	·91	·9719	·31	·98956
·32	·6255	·72	·7642	·12	·8686	·52	·9357	·92	·9726	·32	·98983
·33	·6293	·73	·7673	·13	·8708	·53	·9370	·93	·9732	·33	·99010
·34	·6331	·74	·7704	·14	·8729	·54	·9382	·94	·9738	·34	·99036
0·35	0·6368	0·75	0·7734	1·15	0·8749	1·55	0·9394	1·95	0·9744	2·35	0·99061
·36	·6406	·76	·7764	·16	·8770	·56	·9406	·96	·9750	·36	·99086
·37	·6443	·77	·7794	·17	·8790	·57	·9418	·97	·9756	·37	·99111
·38	·6480	·78	·7823	·18	·8810	·58	·9429	·98	·9761	·38	·99134
·39	·6517	·79	·7852	·19	·8830	·59	·9441	·99	·9767	·39	·99158
0·40	0·6554	0·80	0·7881	1·20	0·8849	1·60	0·9452	2·00	0·9772	2·40	0·99180

Continued …….

x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
2·40	0·99180	2·55	0·99461	2·70	0·99653	2·85	0·99781	3·00	0·99865	3·15	0·99918
·41	·99202	·56	·99477	·71	·99664	·86	·99788	·01	·99869	·16	·99921
·42	·99224	·57	·99492	·72	·99674	·87	·99795	·02	·99874	·17	·99924
·43	·99245	·58	·99506	·73	·99683	·88	·99801	·03	·99878	·18	·99926
·44	·99266	·59	·99520	·74	·99693	·89	·99807	·04	·99882	·19	·99929
2·45	0·99286	2·60	0·99534	2·75	0·99702	2·90	0·99813	3·05	0·99886	3·20	0·99931
·46	·99305	·61	·99547	·76	·99711	·91	·99819	·06	·99889	·21	·99934
·47	·99324	·62	·99560	·77	·99720	·92	·99825	·07	·99893	·22	·99936
·48	·99343	·63	·99573	·78	·99728	·93	·99831	·08	·99896	·23	·99938
·49	·99361	·64	·99585	·79	·99736	·94	·99836	·09	·99900	·24	·99940
2·50	0·99379	2·65	0·99598	2·80	0·99744	2·95	0·99841	3·10	0·99903	3·25	0·99942
·51	·99396	·66	·99609	·81	·99752	·96	·99846	·11	·99906	·26	·99944
·52	·99413	·67	·99621	·82	·99760	·97	·99851	·12	·99910	·27	·99946
·53	·99430	·68	·99632	·83	·99767	·98	·99856	·13	·99913	·28	·99948
·54	·99446	·69	·99643	·84	·99774	·99	·99861	·14	·99916	·29	·99950
2·55	0·99461	2·70	0·99653	2·85	0·99781	3·00	0·99865	3·15	0·99918	3·30	0·99952

The critical table below gives on the left the range of values of x for which $\Phi(x)$ takes the value on the right, correct to the last figure given; in critical cases, take the upper of the two values of $\Phi(x)$ indicated.

3·075	0·9990	3·263	0·9994	3·731	0·99990	3·916	0·99995
3·105	0·9991	3·320	0·9995	3·759	0·99991	3·976	0·99996
3·138	0·9992	3·389	0·9996	3·791	0·99992	4·055	0·99997
3·174	0·9993	3·480	0·9997	3·826	0·99993	4·173	0·99998
3·215	0·9994	3·615	0·9998	3·867	0·99994	4·417	0·99999
			0·9999		0·99995		1·00000

When $x > 3{\cdot}3$ the formula $1-\Phi(x) \doteqdot \frac{e^{-\frac{1}{2}x^2}}{x\sqrt{2\pi}}\left[1-\frac{1}{x^2}+\frac{3}{x^4}-\frac{15}{x^6}+\frac{105}{x^8}\right]$ is very accurate, with relative error less than $945/x^{10}$.

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